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PCT/GB2005/004493

The Patent Office
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I also certify that the application is now proceeding in the name as identified herein.

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Dated 8 June 2005

GB0408722.7

By virtue of a direction given under Section 30 of the Patents Act 1977, the application is proceeding in the name of:-

RACK ARMOUR LIMITED
Incorporated in the United Kingdom
Unit 3, Shawfield Road
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BARNSLEY
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ADP No. 09015991001

Patents Form 1/77

Patents Act 1977
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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

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1. Your reference P7353/RGP GMT-11469

20APR04 E889790-1 B23989
P01/7700 0.00-0408722.7 NONE

2. Patent application number *(The Patent Office will fill this part in)* 0408722.7

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

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FILED 27.01.05
APPLICATION
SECTION 15(4) ARTICLE

Patents ADP number *(if you know it)* 8852412001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

PALLET RACK IMPACT PROTECTOR

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

NO AGENT FOR CORRESPONDENCE

FRANKS & CO
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Patents ADP number *(if you know it)* PST 11.1.05.

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
N/A		

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier UK application	Date of filing *(day / month / year)*
N/A	

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request?

NO

Answer YES if:

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.

Otherwise answer NO (See note d)

Patents Form 1/77

9. Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form:

Continuation sheets of this form	TEN (10)
Description	FIVE (5) ✓
Claim(s)	ONE (1) ✓
Abstract	~~ONE (1) (INCLUDED IN DESCRIPTION)~~
Drawing(s)	FOUR (4) + 4 ✓

10. If you are also filing any of the following, state how many against each item.

Priority documents	NO
Translations of priority documents	NO
Statement of inventorship and right to grant of a patent (Patents Form 7/77)	NO
Request for a preliminary examination and search (Patents Form 9/77)	NO
Request for a substantive examination (Patents Form 10/77)	NO
Any other documents (please specify)	NO Abstract included on page 1 of description

11. I/We request the grant of a patent on the basis of this application.

Signature(s) Gordon Thelwell Date 17th APRIL 2004

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

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b) Write your answers in capital letters using black ink or you may type them.

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f) Part 7 should only be completed when a divisional application is being made under section 15(4), or when an application is being made under section 8(3), 12(6) or 37(4) following an entitlement dispute. By completing part 7 you are requesting that this application takes the same filing date as an earlier UK application. If you want the new application to have the same priority date(s) as the earlier UK application, you should also complete part 6 with the priority details.

TITLE
Pallet Rack Impact Protector

ABSTRACT

A pallet rack upright column protection device for the use in preventing and reducing destructive levels of kinetic energy of motion from occurring to a pallet rack upright. The device is made from an assembly of multilateral polymer based elastomeric materials that has a primary external component with a synergistic less dense internal component. The invention attaches directly to the front and lateral sides of the lower section of a rack upright. (FIG 1)

BACKGROUND OF INVENTION

The logistics of bulk storage and transport of goods and materials require an effective and efficient use of storage space. Pallet racking offers the ability to store items using ever increasing capacities of vertical space up to the height and depth of the racks own dimensions. Adjustable Pallet Racking (APR) is the most common type of pallet racking systems in use throughout the world. APR is a skeletal system of vertical, diagonal and horizontal interconnecting steel members. APR installations are usually constructed with a one pallet deep run of racking on each side of the operating aisle. If the racks can only be accessed from one side only by Mechanical Handling Equipment (MHE) then this is called a single entry run. If the racks can be accessed from both sides then this is called a double entry run

Racking consists usually of two major components upright frames and beams. Upright frames are assembled using pairs of continuously perforated uprights connected by bracing members with bolted, riveted or welded joints. Upright frames are interconnected by beams in pairs to form a row of bays (FIG 3). Pairs of beams are spaced vertically in each bay at a number of levels to provide locations for the pallet or unit loads. Each pair of beams at each level can carry one, two or more unit loads depending on length and strength. The strength, stiffness and stability of racking is provided by the upright frames and their connections to the concrete floor slab (FIG 4) both of which must be maintained within the manufacturers operating parameters in order to be safe.

By the very nature of its designed task, Mechanical Handling Equipment (MHE), such as a Fork Lift Truck, must operate and manoeuvre within very close proximity to pallet racking equipment in order to transit, store and retrieve unit loads between and within the racks structure respectively. During these operations, there is a likelihood that destructive dynamic impact forces between the moving MHE and the pallet racking may occur.

Damaged racking uprights have specific tolerances within which they must operate in order for them to be used safely. The upright and bracing sections of a racking frame are designed for bearing a vertical load. Lateral impacts can have severe safety and financial loss potential. The recommendations given in the Storage Equipment Manufacturer's Association (S.E.M.A) Code of Practice is considered within the storage industry as the safe minimum standard with which to measure the safe condition of racking;

- *'For an upright bent in a lateral direction from its front, a vertical concave dent exceeding 5mm over a 1000mm plain of measurement is considered dangerous and should be decommissioned and replaced.'*

- *'For an upright bent in the plane of the frame bracing, a vertical dent exceeding 3mm over a 1000mm plain of measurement is considered dangerous and should be decommissioned and replaced.'*

- *'For an upright which has been damaged such that there is a simultaneous bend in both longitudinal and lateral directions the left to right and front to back deformation shall be measured separately.....and the appropriate limits observed.'*

Although dominated by vision, operating MHE is a highly cognitive task. It usually occurs in a visually cluttered environment, requires the simultaneous use of central and peripheral vision and involves relatively complex MHE-control activities. Whilst functional differences between the central and peripheral visual fields are well documented, the linkage between the two is less understood. In a typical test of the visual field, the operator fixates on the point where the raised palletised load is situated. Thus, a standard visual test cannot predict how efficiently an operator can use peripheral visual information in complex tasks such as operating MHE. Peripheral retinal sensitivity, under photopic and mesopic (artificial) lighting conditions, (such as is found in a typical warehouse environment) is considerably reduced compared to the central retina. This means, that for an object to be seen peripherally it would need to be of higher intensity than if it was to be detected centrally (Hence the conspicuous colour chosen for the current invention). This can be easily attributed to the distribution characteristics of the human photoreceptors (rods and cones) on the retina. It has been shown that peripheral retinal sensitivity may be impeded as the amount of information the subject is required to process mentally is increased. This visual field "narrowing" may be applied to the warehouse environment, in that an operator's attention is usually divided between the relevant features of the warehouse environment and other tasks, such as the simultaneous controlling of speed and direction of the MHE and its load, navigating with aisle signs and using in-MHE information systems.

As a consequence, important visual stimuli in the periphery may remain undetected when cognitively demanding tasks involving central vision are being performed. Thus, the proximity of the MHE to the vulnerable lower sections of an upright section is difficult to monitor in a manner that is reasonably practicable and the risk of impacts occurring increases. Invariably, such damage has direct costs to organisations resources. Warehouse maintenance may absorb an average of only five per cent of total warehouse costs but any neglect of the issues can have cost consequences far beyond that fraction. Direct costs (e.g. Component replacement and labour costs, damaged stock, damaged MHE, accidents and incidents) and indirect costs (e.g. reduced storage capacity, administration costs, employee absence, litigation, increased insurance premiums, adverse publicity and overall disruption of business).

I propose with my invention to prevent and reduce the likelihood or mitigate actual damage potential to racking uprights to the lowest levels so far as is reasonably practicable.

SUMMARY OF INVENTION

The pallet racking upright protection device according to the present invention self attaches to the front and lateral sides of the aisle facing rack upright. The composite device constitutes two or more major components. The outer component is made from a resilient elastomeric polymer based material that is semi tubular in shape (FIG 1-2). This component serves to deflect and diffuse kinetic energy of motion so as to prevent or minimise impact damage to the upright and the frames components therein. The internal component of the invention is made from a less dense elastomeric material. This internal component (FIG 1-3), synergistic in form and function to the external component, serves to receive and further diffuse the kinetic energy of motion from impacts and promote the repositioning of the whole device to a position similar to before the impact occurrence.

BREIF DESCRIPTION OF DRAWINGS

Figure 1 shows a top down cross section view of a racking frame upright 1 and an embodiment of the upright protectors' external impact deflector 2, and internal impact shock diffuser 3.

Figure 2 shows a plan view of the upright protector mounted to a racking frame with a pair of beams attached.

Figure 3 shows an isometric view of a single bay of adjustable pallet racking with two mounted upright protectors.

Figure 4 shows a side section view of a racking frame with a mounted upright protector 2. The racking frame consisting of uprights 1, standard footplate 3, diagonal cross bracing 4, horizontal cross bracing 5, fixed to floor with mechanical anchor bolt fixings 6.

Figure 5 shows a front perspective view of an embodiment of the upright protector mounted to the racking upright.

Figure 6 shows a rear perspective view of an embodiment of the upright protector mounted to the racking upright.

Figure 7 shows an embodiment of a distinct advantage of the current inventions curved shape. Off centre Impact forces 1 to the external component 2 are subjected to an increased length of penetration 3 thus offering an increased impact resistance by shear design.

DETAILED DESCRIPTION OF INVENTION

The embodiment of the upright column protector substantially is herein described below according to the current invention and is illustrated in the accompanying drawings.

The pallet racking protection device according to the current invention directly encapsulates the external frontage and lateral sides of the aisle facing frame upright. The device does not necessarily require any additional fastening devices to secure it in place due to the innate elastomeric properties of the material it is manufactured from. After an impact event occurs, the elastomeric construction of the polymer material reverts to their equilibrium configurations and thus the device returns to its original dimensions.

Without this device, the kinetic energy of motion is concentrated within a relatively small area on the upright instantaneously. Therefore, a very large dynamic force is transmitted from the MHE to the upright. This acute change in velocity and exchange of impact energy exceeds the structural tolerances of the racking causing damage and increased hazards and risks associated with collapsing weight bearing structures.

The external 'shock deflector' component is manufactured from, but not necessarily, a polymer based material, preferably High Density Polyethylene. Further, this component is of such dimensions and mass so as to veer and diffuse kinetic energy of motion it receives away and around the upright it is attached to. Additionally, it is manufactured in such a form so as to posses a very strong internal cross linked polymer composition that enhances its impact deflecting and shock diffusing properties. The semi tubular shape together with the innate properties of tubular extruded high density polyethylene gives this outer component a low friction coefficient surface with high deflecting properties. This shape also accommodates the propagation of shock forces internally along its curved structure away and toward the rear of the upright into the ambient atmosphere. This 'curving' of the component also increases the length of the penetration path by 1/sin of the sloping angle to any off centre impacts (FIG 7). The simultaneous deflecting and diffusing action will greatly reduce the impact forces from being transmitted to the vulnerable front and lateral faces of the rack upright. Further, the external 'deflector' is of such dimension that it also offers deflecting protection to the rear of the upright from loads being removed from the racking thus mitigating the probability of the upright receiving twisting deformation within its own axis.

The internal 'shock isolator' component of the device is of such a shape and form so as to provide a flush interface between the internal profile of the 'shock deflector' component and the various types of external profiles of different manufacturing types of racking uprights. The 'shock isolator' component encapsulates the front face and portions of the lateral sides of the upright. This component is manufactured from, but not necessarily, closed cell SBR foam. The shape, mass, density and internal structure of the shock isolator has such properties so as to induce inertia and an exaggerated path to shock forces. The shock isolator receives residual kinetic energy of motion from the 'deflector' component, momentarily stores this energy and releases it over a relatively longer period of time and over a relatively larger internal surface area in all ambient directions. A proportion of this energy is rebounded back through the 'deflector' away from the racking. This whole process will eliminate or conduct a smaller dynamic force from reaching the upright that will then be within the safe impact threshold of the upright and avoiding residual damage to the racking components and goods stored therein.

ADVANTAGES OF THE INVENTION

According to the current invention the impact protector is designed to absorb and dissipate the shock of a blow. The potentially destructive kinetic energy of motion is spread over as large an area as possible and as long a distance as possible thus diluting concentrated forces that would lead to structural failure.

The ergonomic shape of the whole device allows it to be applicable to various types of different racking upright profiles for a universal accommodation of the invention. Whilst the end user may change his or her make of racking, the expense of also changing the upright protector will be avoided with using the current invention.

Further, the design of the current invention proactively accommodates occupational ergonomic considerations with regards to manual handling. It is lightweight, easy to install, has no sharp profiles and does not necessarily require any additional fastenings or anchor bolts in order to be installed.

The current invention ensures the stability of pallet racking in a given direction that is directly proportional to the horizontal distance of the centre of gravity from that edge of the base toward the given direction of movement.

The external shape of the current device aims to ensure that the coefficient of friction is independent of the area of contact between the impacting load and the pallet racking thus reducing the likelihood of impact damage.

For every action there is always an equal and contrary reaction, whilst the majority of the kinetic energy of motion is dissipated throughout the device, a portion of the kinetic energy is transmitted back to the body which initiated the impact forces. Therefore reducing the destructive kinetic energy of motion transmitted to the pallet racking upright.

The low profile of the device is such that once attached to the rack upright, the device does not prohibitively encroach or reduce the required safe operating clearance dimensions of the racking system. During field research, it was identified that all other known rack upright protectors detrimentally reduced required clearances, interfered with the loading and alighting of loads and in many instances became an instrument which caused damage to the rack upright, pallets, palletised stock, MHE and the floor.

The materials used to manufacture the current invention have such innate properties so as to offer persistence of shape. Therefore, in the likely event that an impact does occur, the device has the ability to recover its original protective shape. All other known rack upright protectors do not have this ability.

Further, the current invention is manufactured with a material that is fully recyclable, non corrodible, is chemically resistant, does not harbour the capacity for bacterial growth, does not and in fact prevents the occurrence of impact ignition sparks in a flammable atmosphere and does not accommodate moisture retention. In preventing the paintwork of the rack upright from being degraded or scratched, the device prevents the likelihood of the rack upright and MHE from rust and corrosion.

Due to the flexible and closing properties of the tubular profile, the current invention grasps the rack upright it protects thus negating the need to drill and fix mechanical or chemical floor fixing bolts or devices. Therefore, the important integrity of the floor foundation the rack is built upon is not compromised as well as avoiding costly installation and maintenance. In addition to these potential installation difficulties, the device is designed to fail to safety in the unlikely event that it is snagged by MHE and will release itself from the rack upright before twisting deformation of the rack upright occurs.

The current invention is not necessarily restricted for the use of pallet rack impact protection. The inventor realises that it can be applied to any orientation of any column or structure that would benefit from impact protection

It is acknowledged by the inventor that whilst the impact protector is in position, visual safety inspections of the rack upright will entail sliding the device up and then back down. Whilst this task may be relatively easy, an additional feature to the invention may be developed once the impact performance of the device is established by an independent impact testing authority. The additional feature would be a polycarbonate outer sheath to the device that shall only fail to crack propagation from forces that would exceed the devices impact tolerance. Alternatively, a similar polycarbonate insert that could be inserted between the device and the front face of the rack that could then be easily removed and reinserted for visual inspection purposes.

CLAIMS

1. An upright column protector consisting of an assembly of elastomeric synthetic compound components that partially encapsulate the principal elements of the vertical sections of a metal pallet rack for the purpose of preventing impact damage caused to the pallet rack by mechanical handling equipment.

2. A device as claimed in Claim 1, wherein the assembly of multilateral, semi tubular, components has greater ductility, impact resilience and persistence of shape than that of the metal rack component it is attached to.

3. A device as claimed in Claim 2, wherein the assembly of components does not essentially concomitant an integrated or independent fastening or securing mechanism or mechanisms or bonding agent with which to be fixed to a pallet rack.

4. A device as claimed in Claim 3, wherein there is an external component that is semi tubular in shape and is manufactured from, but not necessarily, Polyethylene, Polypropylene, Polycarbonate, Polyvinylchloride or Polystyrene plastic or mixture of plastics.

5. A device as claimed in Claim 3, wherein there is an internal component that is synergistic in form and function to that of the external component and is manufactured from, but not necessarily, Polyethylene, Polypropylene, Polycarbonate, Polyvinylchloride, Polystyrene, natural or synthetic rubber foams or compressible composite materials.

6. An upright column protector substantially as herein described above and illustrated in the accompanying drawings.

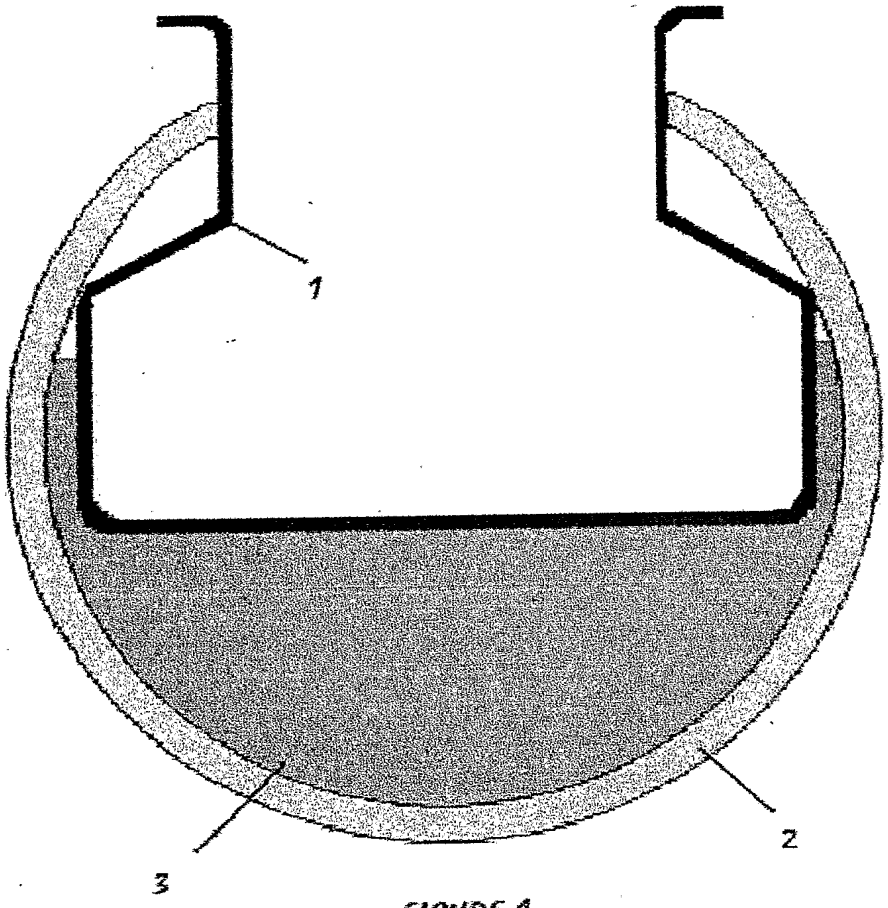

FIGURE 1

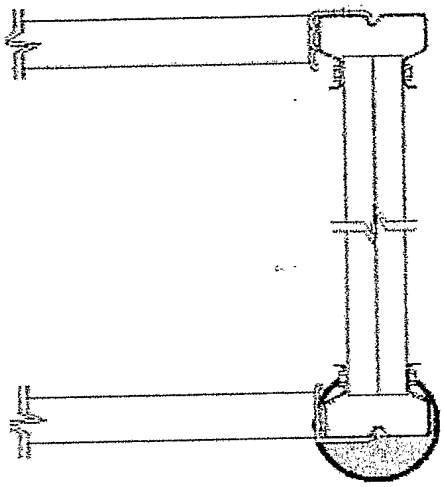

FIGURE 2

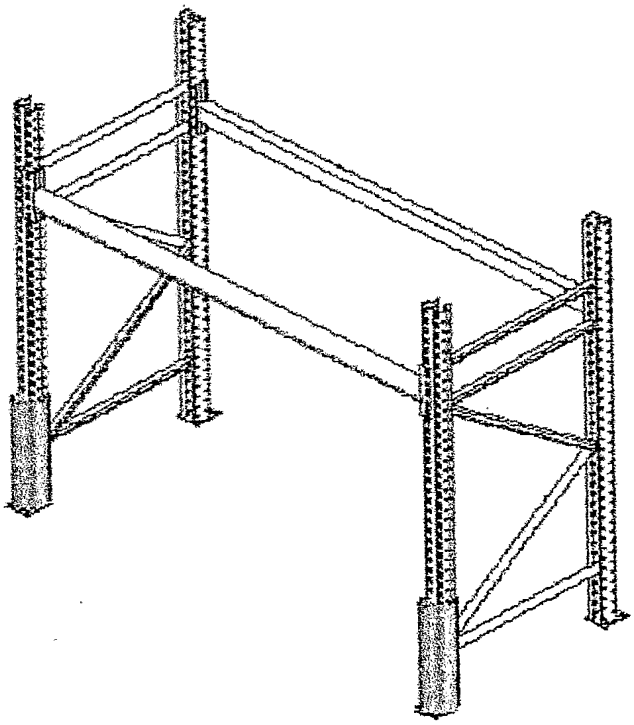

FIGURE 3

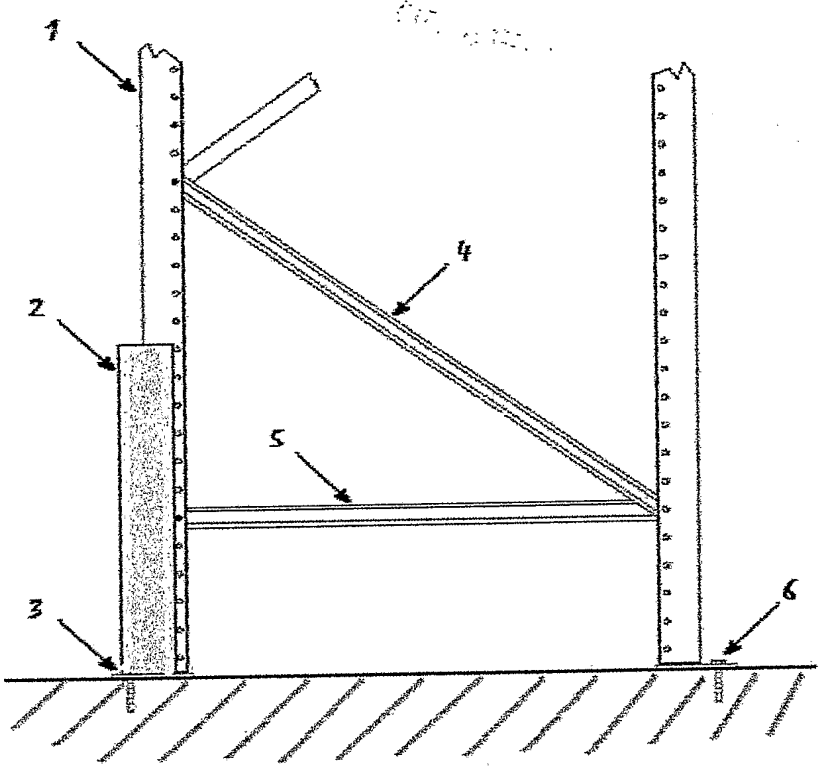

FIGURE 4

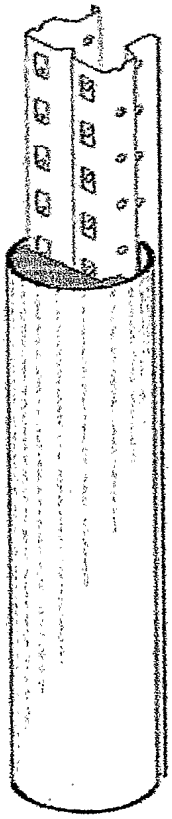

FIGURE 5

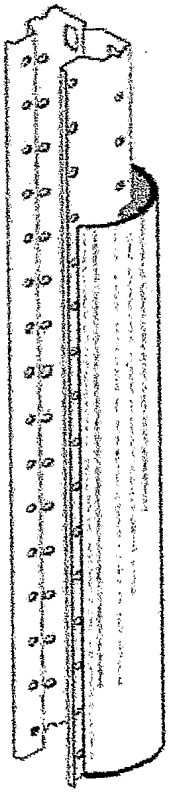

FIGURE 6

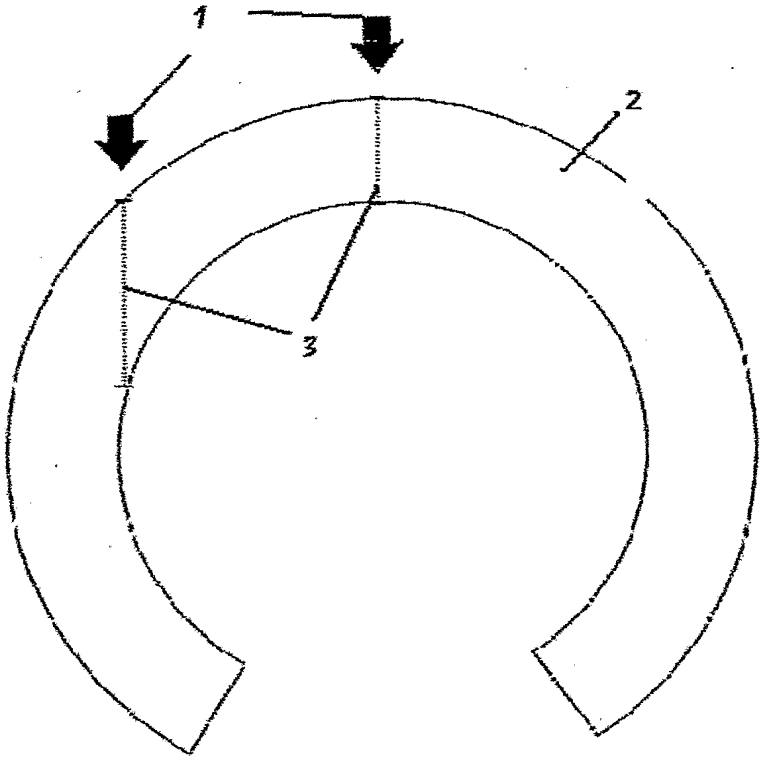

FIGURE 7